Magnesium

Is it a viable option?

Presented by:
EMI Quality Plating

Report Documentation Page

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AGENDA:

- Introduce audience to current products being made in magnesium.
- Explain process for effective plating onto magnesium.
- Testing completed on E/N plated Mag
- New technology for conductive, highly protective magnesium coating.
- Test results of “unobtainium”

`1935 Bugatti

Weapons platforms and sound suppression manufacturer

The Gen 4 Receiver

Magnesium is 35% lighter.

Gen 4 receiver is coated with High Phos E/N and Ceramtek B

Military communication devices.


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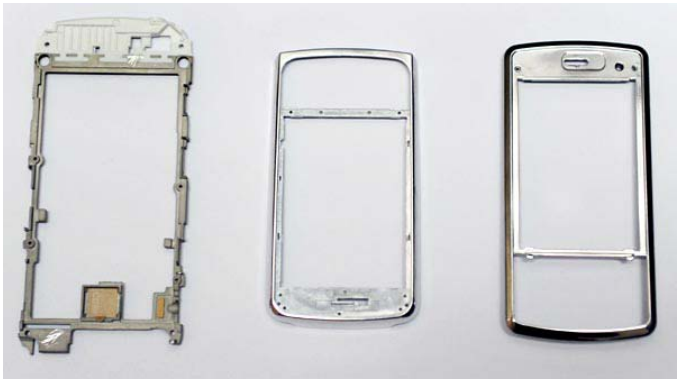
Magnesium in consumer products.



Keys to successful plating:

1. The condition of the casting, molding or extruded materials are key to successful plating.
   - Flash, parting lines, segregation of materials, packaging

2. Process steps:
   - Soak Clean
   - Micro-etch
   - Acid
   - Activator (removes aluminum, cu, zinc from surface)
   - Zinc immersion - High alkalinity
   - Copper strike - High alkalinity
   - Magnesium strike – High alkalinity
   - Electroless Nickel - formulated to prevent attach of magnesium.

Success Stories:

1. Thermal Cycle per ASTM B733 on AZ91D
2. Salt Fog 248 hours per Mil-Std-810F, Method 509.4.
3. Cass Testing 48 hours per ASTMB368
4. Field Testing on assembled unit: 1 year in Afghanistan
5. Drop Testing from various distances
6. Grind Saw testing per ASTM B571-97
7. Cyclic corrosion testing per SAE J2334
8. Step testing (thickness and electrode potential of individual layer in a multi layer deposit
9. Achieved cosmetic and shielding requirements by customer

Cyclic testing described

Cyclic Conditions in Basic Cyclic Cabinets

1. Salt or chemical (electrolyte) fog, saturated RH
2. Water fog, saturated RH
3. Dry-off
4. Dwell, a period of rest where no action is taken
5. Non-condensing humidity (i.e., “moist heat”)
6. Direct spray (impingement), salt or other chemical
7. High temperature, up to 70°C/160°F
8. Gas injection, including Nox, SO2, CO2, etc.

Cyclic Conditions in Advanced Cyclic Cabinets

All in preceding column, plus:

9. Controllable humidity, ambient to saturated RH
10. Immersion
11. Second Electrolyte, for fog or direct spray
12. Very low temperature and RH, automatic
13. Ambient temperature and RH, automatic
14. Very high temperature, up to 90°C/195°F

New Challenges for magnesium coatings:

Our customer presented us with a detailed specification For the coating we would put onto an AZ91D molding.

- They need 500 hour salt fog minimum.
- They need the deposit to be conductive.
- The surface needs to meet an RA of less than 5u”

The response:

After much consideration, we determined that we needed the Corrosion protection that an anodizing process would provide And be able to plate the anodized finish.

EMI has developed technologies that allow us to plate Various ceramics including titanium nitride, Barium nitride, and AlsiC.

We are also heavily involved in production launches /projects for plating of Composites such as POM, Acetal, Polyester, Polypropylene, Nylon, Peek and Ultem with 40% class.

Utilizing the database and information collected during development of said materials, we began sampling the anodized magnesium

AZ 91D Magnesium plaques were supplied by customer, several of Which had already been coated with Keronite. EMI also sent parts Out to be coated with Cerafuse.

The plating process was then developed utilizing a soak cleaner, mild Alkaline etch, ionic palladium, palladium reducer, electroless copper and electroless nickel.

The initial results were encouraging: We were able to Get the parts to plate with good adhesion and our plating was Conductive.

The parts are currently in salt fog testing. They have been In test for 746 hours and only white/green corrosion has been Seen at the surface of the nickel. We are leaving the parts in Test until there is evidence that magnesium is corroding.

There is no evidence of corrosion to the magnesium And no galvanic corrosion has set up yet.

Parts were tested to the customer specification for shielding And passed. The specification is:

EMI Shielding requires 20 – 5 ohms/sq or 20dB
(for frequencies 250 MHz – 10 GHz.)

Where we go from here:

Provide samples of actual part (with all complex Geometries)

Test using same parameters.

Validate process repeatability and production readiness.

- We are encouraged by the results on salt fog.
- EMI will continue to work on all anodized/ceramic coatings for
- Magnesium, to ensure process works and can be ramped To production environment.

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